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MODIFIED AODV WITH CURRENT BANDWIDTH CALCULATION FOR MOBILE ADHOC NETWORKS

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ABSTRACT

Meeting bandwidth demand successfully is one of the important issue for multimedia application. In this paper I propose a protocol of AODV routing protocol named as ICBCC–AODV (Integration of current bandwidth capacity calculation) protocol which calculates current bandwidth compares with required bandwidth and then forwards data to destination.

KEYWORDS: Mobile Ad-Hoc Network, QoS, AODV, Bandwidth Estimation, Routing Protocol

I. INTRODUCTION

Many routing protocols have been proposed in ad hoc networks, and these can be classified into two categories: table-driven (proactive) protocols and on-demand (reactive) protocols. Reactive protocols: create and maintain routes only when they are desired, and differ on how they discover and maintain routes between sources and destinations. Proactive protocols: require each node to maintain one or more tables to store routing information from each node to all other nodes in the network, regardless of whether they are actually used or not. In this article we are interested by Ad hoc On-demand Distance Vector (AODV) Routing protocol [2]. AODV is a distance vector routing protocol. AODV is an pure on demand routing protocol, so that a route is only discovered when required by a source node. A node does not need to keep routing or reserve bandwidth that does not need. AODV eliminates periodic routing updates and propagate if nodes bandwidth capacity is satisfied by the nodes required bandwidth to be send to the destination. A majority of ad hoc applications involve voice communications while some may require video transmissions. Thus Quality of Service (QoS) is desired to provide the required service differentiation to the demanding connections. However providing QoS assurance in MANETs is a very complex problem due to the characteristics of the network, such as the mobile nature of the nodes resulting in an unpredictable topology, scarce wireless bandwidth which varies with the changing environmental conditions, limited mobile device power and the requirement of node cooperation to relay packets through the network. In this paper we propose and implement an enhanced version of AODV, using the Network Simulator 2 (NS2)The main objectives of this work is to propose a QoS aware AODV routing protocol based on the draft “Quality of Service for Ad hoc On-Demand Distance Vector Routing” [1], to implement (using C++ programming language) this by amending the source code of the existing AODV routing protocol employed within NS2 and analyse (using TCL(Tool Command Language), AWK (Aho Weinberger Kaho)) the effects of these changes and, comparing the ICBCC_AODV network performance measures (i.e traffic delay, bandwidth) with the unchanged AODV protocol. In the section II, we present some QoS works in the ad hoc networks. Section III describes the problem definition and the network model. Our admission control is described in section IV, the oS_AODV route establishment is explained in section V, in section

VI we propose a mechanism to calculate the CBC for a given node. Simulation results and a comparative study are presented in section VII, the last section conclude our paper.

II. LITERATURE

In the literature, the research on QoS support in MANETs spans over all the layers in the network [4]:

- QoS models specify an architecture in which some kinds of services could be provided.
- QoS Adaptation hides all environment-related features from awareness of the multimedia-application above and provides an interface for applications to interact with QoS control.
- QoS routing is part of the network layer and searches for a path with enough resources but does not reserve resources.
- QoS MAC protocols are essential components in QoS for MANETs. QoS supporting components at upper layers, such as QoS signaling or QoS routing assume the existence of a MAC protocol, which solves the problems of medium contention, supports reliable communication, and provides resource reservation

Existant Approaches

- SWAN [5] is a QoS provisioning system that treats UDP traffic as real time and TCP traffic as best effort. It uses admission control based only on bandwidth measured along the path of communication by sending a probe message.
- The QPART protocol [8] is based on a passive estimation of bandwidth and a dynamic regulation mechanism of best effort flows.
- In [10] the authors propose an improved mechanism to estimate the available bandwidth in IEEE 802.11-based ad hoc networks. They have integrated this bandwidth evaluation technique (ABE) into AODV protocol and implemented it under NS-2. This protocol is called ABE-AODV.

III. PROPOSED AODV ROUTING PROTOCOLNAMED AS ICBCC–AODV (INTEGRATION OF CURRENT BANDWIDTH CAPACITY CALCULATION)

The decision of whether to accept or reject a flow is done by admission control procedure based on resource availability basis. In reactive routing protocol AODV, when a node wants to communicate to another node and does not know a route to the destination, it sends out a route request (RREQ) message

I extend this RREQ message to include the quality of the wanted route to destination in terms of ICBCC parameters like maximum end-to-end delay, minimum bandwidth (MB).

I Denote

ICBCC_AODV_RREP = RREP U {MB, D}

Where D is the required maximum end-to-end delay, MB is the minimum bandwidth that the application will require, RREQ is the RREQ packet of original AODV, RREP is the RREP packet of original AODV. So the route to the destination must have available bandwidth greater than or equal to MB. In our protocol the source node's network layer

gets a request in the format of ICBCC_AODV_RREQ (figure 1), from its application. It removes D from ICBCC_AODV_RREQ, stores D locally, starts a timer with value 2*D, and sends out the route request RREQ with the remaining parameters. When an intermediate node gets this ICBCC_AODV_RREQ, it uses MB to determine whether to forward the route request or drop it. An intermediate node compares the requested minimum bandwidth (MB) with its current bandwidth capacity (CBC). If the node's CBC is higher, the node rebroadcasts the route request to its neighbours. If the CBC is less than MB, the node drops the route request. By this way if the ICBCC_AODV_RREQ reaches the destination by satisfying the bandwidth constraint then the destination records the MB contained in the ICBCC_AODV_RREQ and replies with a ICBCC_AODV_RREP To include the user defined quality of service parameters (minimum bandwidth (MB) the AODV RREQ packet is modified. The RESERVED field within the normal AODV RREQ packet is used to carry the information during the route establishing process. This extended version of the AODV RREQ will be referred as ICBCC_AODV RREQ (figure 1). The RESERVED field has total length of 16 bits, the maximum value that can be passed in a ICBCC_AODV RREQ packet is 65536 (216).

IV. ICBCC_AODV ROUTE ESTABLISHMENT

To describe how the ICBCC_AODV works, consider a scenario in which a node , S wishes to communicate with another node, D. if node S has no valid path(s) to D in its routing table, then a route request is initiated. Node S broadcasts the extended AODV RREQ packet to its neighbours. Upon receiving these RREQ packets, the intermediate nodes (n1, n2,…,nj) compare the RREQ_ICBCC_BANDWITH field value, within the RREQ packet, say, x kbps with their Current Bandwidth Capacity, CBC kbps. If these intermediate nodes are already engaged in other traffic sessions then their total available bandwidth capacity will vary. The nodes which cannot accommodate the user-specified minimum bandwidth, x kbps, the 'busy' nodes, will not discard the ICBCC_AODV_RREQ initially it will forward ICBCC_AODV_RREQ to the successor if not satisfied there it forward to predessor if not satisfied there also it will be discarded. The nodes which do satisfy the bandwidth requirement, broadcast the ICBCC_AODV_RREQ to their neighbours. A reverse route entry is added in the routing table of the ICBCC_valid node that unicasts the ICBCC_AODV_RREQ packet. This process continues until a node receives the ICBCC_AODV_RREQ and has a fresh enough route to the destination node, D in its routing table, or itself is the destination node:

V. DYNAMIC CURRENT BANDWIDTH CAPACITY (CBC) CALCULATION

Below we propose a mechanism to calculate the CBC for a given node which will be implemented and incorporated within the AODV routing protocol in NS2.The proposed method to monitor and update a nodes traffic status in based upon session flows. This will include keeping track of the various flow statistics over a period of time. The instance at which a traffic flow session is started at any given node, the start-time for every unique flow session is stored. As the data packets arrive and are processed by the nodes, other information necessary for the CBC calculation is extracted from the IP data packets such as: packet size, flow id, source node, destination node, etc. For each individual session flowing through a node, the total number of bytes (calculated from the data packet size for each different flow) sent/forwarded by the node is monitored .The start-time for each flow is used to work out the interval between packets which are part of the same flow. The CBC is calculated and updated constantly and is a new addition to the nodes routing table.

Formula used to calculate bandwidth is:

CBC[j]=8*sum[j]/((end_time-start_time)/1000)

Where:

j: flow number

sum[j]: sum of all flow j packet size in byte.

CBC[j]: current bandwidth capacity of flow j.

Below are the flowcharts of the RREP and RREQ which shows whole working of the proposed algorithm.

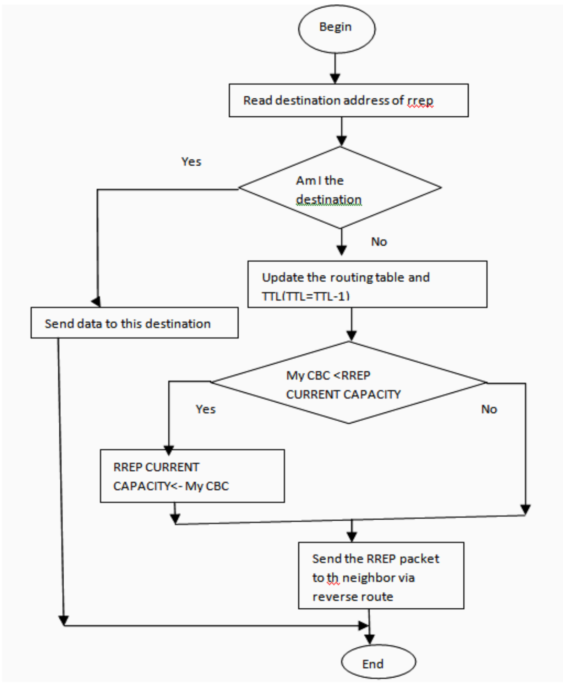

Figure 1: Flowchart for RREP in IBCC-AODV

Evaluating ICBCC_AODV performance metrics to analyze the effectiveness of the proposed and implemented ICBCC_AODV routing protocol, the simulation scenario described above is carried out with the normal AODV protocol and the extended ICBCC_AODV one. Network performance metrics will be used to compare the results, are the end-to-end delay of the traffic flow/session, packet delivery ratio. [packet_Time (destination)-Packet_Time (source)], and the node bandwidth processing performance: as the ultimate valid path chosen by ICBCC_AODV that satisfies the quality of service defined, depends on the status of each node, analyzing the CBC values for all nodes involved can will verify the routing decision undertaken by the ICBCC_AODV routing protocol.

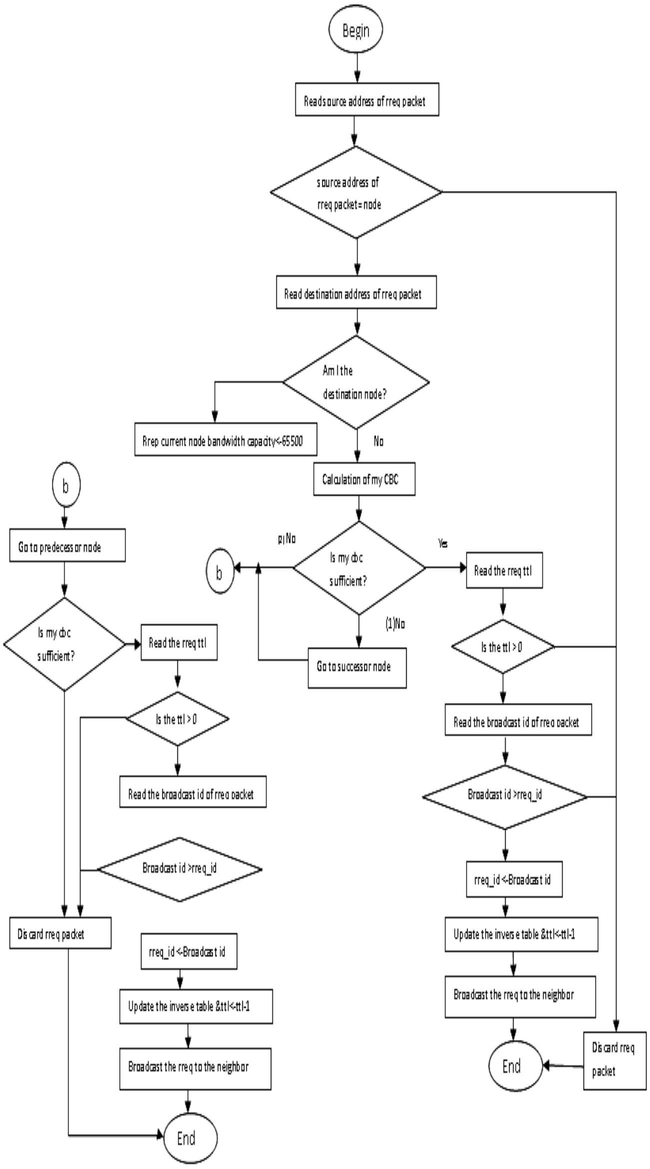

Figure 2: Flowchart for RREQ of IBCC- AODV

VI. SIMULATION

Table 1: Simulation Parameters

Parameter	Value
Topology Size	500x500
Simulation time	200s
Number of Nodes	10 20 30 40 50 60 70
Different traffic sources	2
Traffic flow 1	Normal AODV
Traffic flow 2	AODV_IDBCC

The Minimum bandwidth (MB), delay is assumed here according to the readings of normal AODV.

VII. RESULTS

Table 2: Pdr Readings

No of Nodes	Simple AODV	AODV_ICBCC
10	0.999555	0.999514
20	0.999494	0.999453
30	0.999534	1
40	0.999656	1
50	0.999514	1
60	0.999534	1
70	0.999656	1

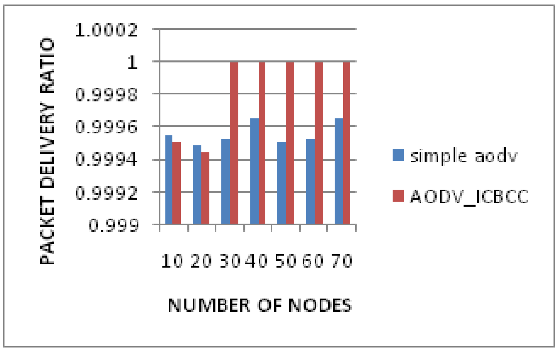

Figure 3: Pdr Graph

Table 3: End to End Delay Readings

No of Nodes	Simple AODV	AODV_ICBCC
10	0.004391	0.062092
20	0.004337	0.062903
30	0.004429	0.204202
40	0.004446	0.181172
50	0.00469	0.163382
60	0.004444	0.155748
70	0.004476	0.154373

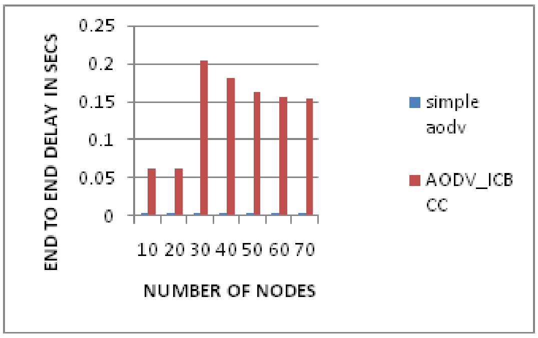

Figure 4: End to End Delay Graph

From the graph we came to conclusion that our pdr increases as number of nodes increases and the end to end delay also increase as number of nodes increases.

VII. CONCLUSIONS

In this paper, an enhanced version of AODV routing protocol was proposed. We have implemented our admission control mechanism using the Network Simulator 2 (NS2) Where the source node checks the end-to-end delay and all the intermediate nodes perform bandwidth check. Our algorithm is based on the modification of the AODV RREQ and AODV RREP packets, to include the user defined quality of service parameters (minimum bandwidth (BP) and maximum delay(D)); it also compute the Current Bandwidth Capacity (CBC) for a given node which will be implemented and incorporated within the AODV in NS2. We have developed some components of the network Simulator NS 2 to adapt our algorithm. It is seen from the simulation results that our proposal ICBCC_AODV gives a very good packet delivery ratio which secures packet from getting dropped thus enhances the node bandwidth processing performance. In future work, we envisage to improve our current ICBCC_AODV proposal by making it compared with others protocols, and making end to end delay better for data to be transferred.

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